

Picometer-Resolution MEMS Segmented DM, Phase II

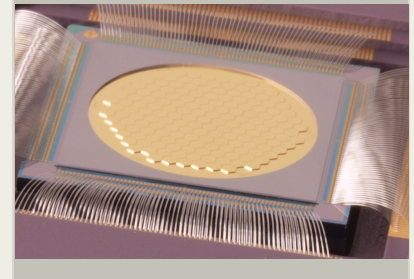
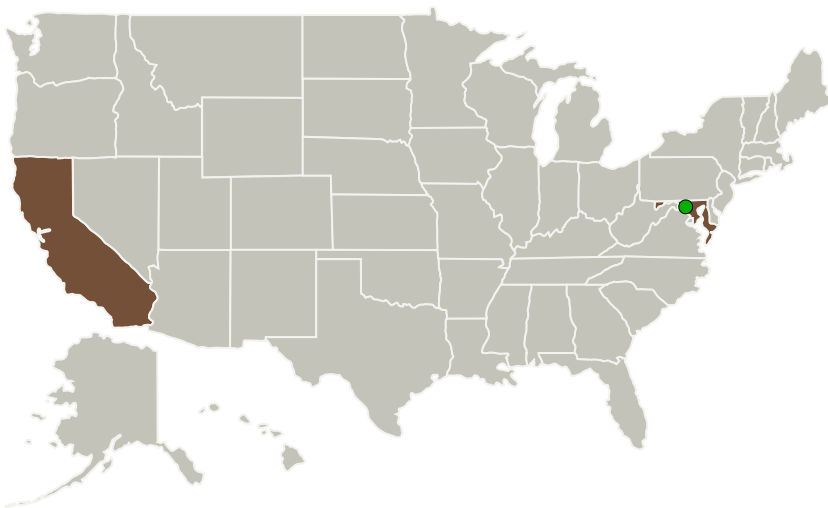
Completed Technology Project (2012 - 2017)



Project Introduction

Microelectromechanical systems (MEMS) technology has the potential to create deformable mirrors (DM) with 10^4 actuators that have size, weight, and power specifications that are far lower than conventional piezoelectric and electrostrictive DMs. However, building a MEMS DM with a relatively large aperture that is flat in the unpowered state is challenging. Currently, a large portion of the mirror stroke must be used to flatten the MEMS DMs. In the case of the large-stroke segmented MEMS DMs manufactured by Iris AO, there is sufficient stroke for wavefront correction after flattening. However, the resolution is significantly reduced because the dynamic range of the digital-to-analog converters (DAC) used to operate the DM is spread over multiple microns of stroke rather than the 0.5 micron range required for a coronagraph. This Phase I SBIR will make substantial improvements in the fabrication process of MEMS segmented DMs that reduce the deleterious residual surface-figure errors. It will do so by systematically addressing the sources of the segment position variations as well as addressing low-spatial frequency chip bow that can result in large peak-to-valley deformations across the DM array. The Iris AO DM architecture will also be modified to enable picometer resolution actuation with ultra-precision drive electronics.

Primary U.S. Work Locations and Key Partners



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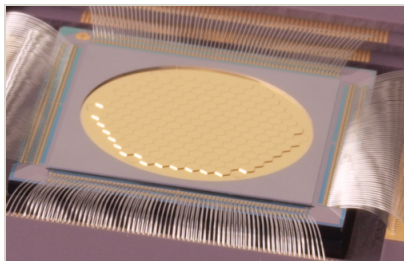
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Organizations Performing Work	Role	Type	Location
Iris AO, Inc.	Lead Organization	Industry	Berkeley, California
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

Images

**Briefing Chart Image**

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(<https://techport.nasa.gov/image/127238>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Iris AO, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Michael A Helmbrecht

Co-Investigator:

Michael Helmbrecht

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Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.2 Observatories
 - └ TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System